Why Not Both? Maintenance of Phenotypic Polymorphism in the Wood Tiger Moth

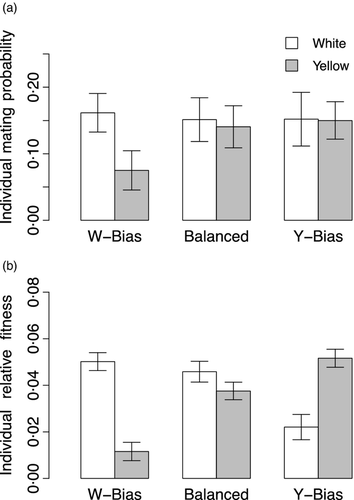
# Full homework handout

Populations of the wood tiger moth (*Parasemia plantaginis*) in Europe have two distinct male color phenotypes, yellow and white. In some populations, the more common phenotype experiences lower survival or reproductive success; this is called **negative frequency-dependent selection**. Negative frequency-dependent selection is a common explanation for why **phenotypic polymorphism** (multiple different phenotypes) can persist in a population over a long time period. However, research by Dr. Swanne Gordon *et al.* investigating the wood tiger moth color polymorphism has discovered a surprising result. They studied the mating patterns of three experimental populations: one with mostly white males (“W-Bias”), one with mostly yellow males (“Y-Bias”), and one with an equal frequency of both types (“Balanced”). *Gordon et al.* found that negative frequency-dependent selection did not appear to be occurring with respect to mate choice. They presented this finding using the figure on the next page.

*Images of both white (left) and yellow (right) male Parasemia plantaginis*Images showing both a male white morph and a male yellow morph wood tiger moth.  

The white more image source is: https://www.flickr.com/photos/105393422@N02/41149816780

The yellow morph image source is: https://www.flickr.com/photos/130093583@N04/21027331599/



**Figure 1.** a) The individual mating probabilities of both white (clear bars) and yellow (grey bars) male morphs in all three treatments white‐biased (16 white males and 8 yellow males), balanced ratios (12 each white and yellow males) and yellow‐biased (16 yellow males and 8 white males). b) The individual relative mating fitness of each morph in the same treatments defined as the proportion of hatched (laboratory reared) larvae that were sired by a given male relative to the total number of males in the focal enclosure. Error bars indicate standard errors.

The top panel (a) in Figure 1 shows the observed average mating probability of white and yellow males in each of the three experimental populations, and the bottom panel (b) shows the relative fitness (here defined as the proportion of offspring that a single male type produced, on average, out of the total number of offspring produced from all matings in that population).

The information above is all you need to understand to complete the following questions. However, you may find it interesting to skim the rest of the research article about this work (the abstract and introduction can be useful for getting the bigger picture of this research in context). ([Full article here.](https://www.jstor.org/stable/pdf/24700624.pdf?refreqid=excelsior%3A4dcc93981dc62593ce1904bccf6b18f9))

### Understanding selection

1. We see data about mating success as two different variables in Figure 1: as mating probabilities, and as relative fitness. In thinking about the long-term evolution of tiger wood moth populations, which of these two variables more directly allows you to predict how the population may change over time? Explain your answer in 1-2 sentences.
2. Looking at panel (b) in Figure 1, in what conditions are yellow males more fit, and in what conditions are white males more fit? What type of selection is occurring here? Explain your answer in 1-2 sentences.
3. Do you expect a color polymorphism to be maintained in this population over many generations, or do you expect one color morph to eventually reach a frequency of 100% in the population? Explain your answer in 1-2 sentences.

### More about Swanne Gordon (modified from the [Scientist Spotlight authored by Ximena E. Bernal](https://scientistspotlights.org/scientist/swanne-gordon/))

Dr. Gordon is an evolutionary biologist and behavioral ecologist. Her work stems around asking the questions of why there is diversity in nature and how it is maintained. In particular, she focuses on the evolution and maintenance of color polymorphisms in warning coloration, rapid evolution, and the interaction between sex linkage and adaptation. Dr. Gordon received a MSc in Biology from McGill University in Montreal and a PhD in Biology from the University of California at Riverside. She did her postdoctoral work at the University of Jyväskylä, Finland and is currently an Assistant Professor at Washington University in St. Louis.

1. Follow this link to read an interview with Dr. Swanne Gordon: <https://biology.wustl.edu/news/faculty-spotlight-swanne-gordon-assistant-professor-biology>.
2. After reviewing this interview with Swanne Gordon, write a ~200-word reflection on what you discovered. You might wish to address some of the following:

* What does this interview tell you about the types of people that do science?
* What was most interesting to you?
* What questions do you have for Dr. Gordon after reading about her background and/or research?